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(56) Documents Cited
GB 1011742 A
EP 0924475 A1
DE 003321612 A1
JP 030137429 A
US 5218998 A
US 2937588 A
EP 0967443 A2
DE 029609754 U
JP 620297656 A
US 5427146 A
US 3186327 A

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(54) Abstract Title
An air conditioner terminal device with air mixing control for a room

(57) The invention concerns a supply air terminal device (10) including side plates (12) and an air guiding part (13). A heat exchanger (14) is fitted in the device below a supply air chamber (11) for supply air in between air guiding parts (13) located on both sides of the central axis (Y_1) of the device. In the device, the supply air chamber (11) includes nozzle apertures ($12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ...) to conduct fresh supply air into a side chamber (B_1) and to induce a flow of circulated air (L_2) from the room space through the heat exchanger 14 into the side chamber (B_1). Using the heat exchanger (14) the circulated air may be either cooled or heated. The equipment includes a control device (15) for the induction ratio of the supply air flow (L_1) and the circulated air flow (L_2) for controlling in which ratio there is fresh air (L_1) and circulated air (L_2) in the combined air flow ($L_1 + L_2$).

Preferably the control device consists of two juxtaposed apertured plates, one fixed and the other slidable in respect to the other. The control device can be disposed in the terminal device, up/down stream, or to the side of the heat exchanger. The device (15) can also be of a pivotal damper type. A means, preferably gears (21, fig.3c) or a cam (19, fig. 2a), is used to move the said slidable plate in a linear direction. The air supply chamber (11) can be circular in cross section (26, fig. 5a) with the control device disposed within, as an apertured cylinder (27 fig.5a), slidable in respect to the nozzles.

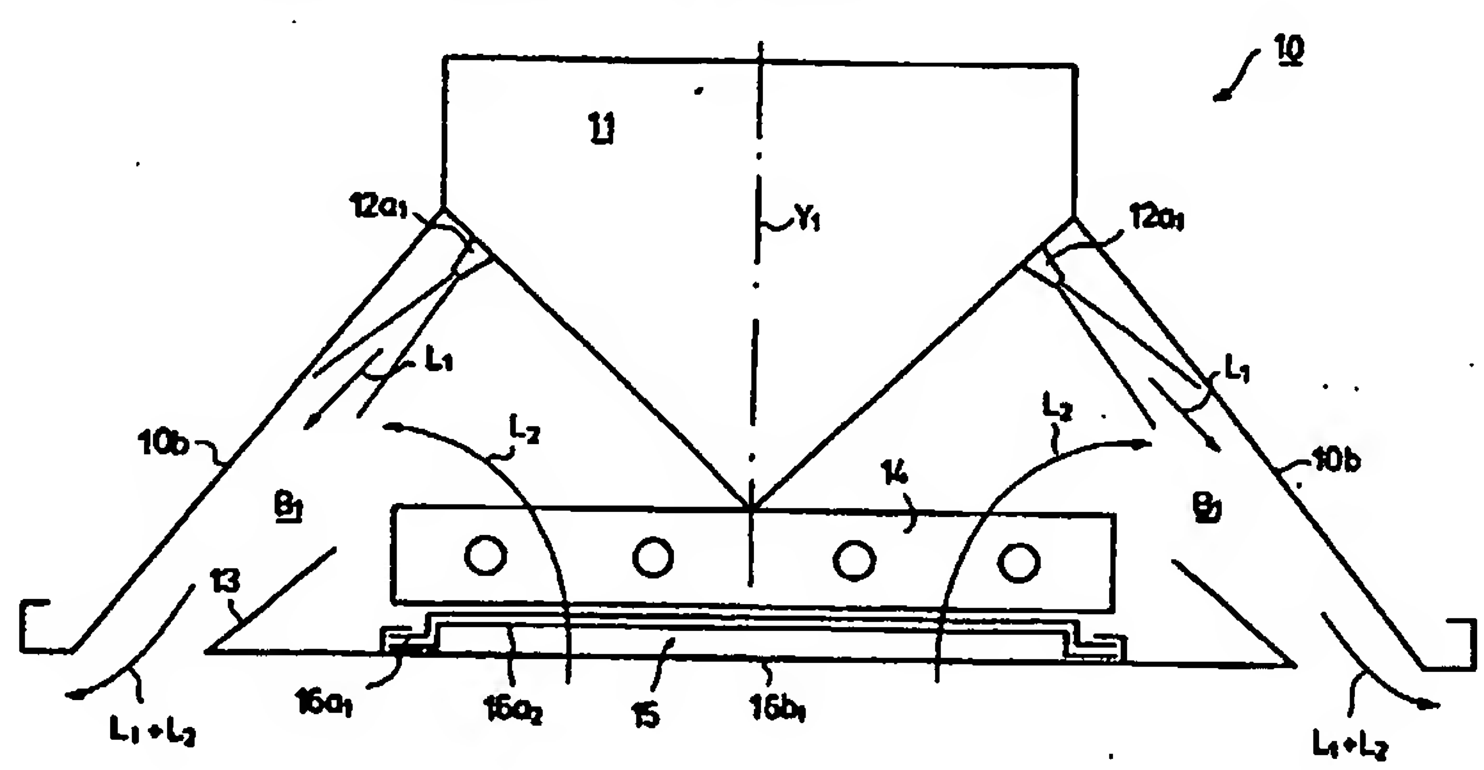

FIG. 1B

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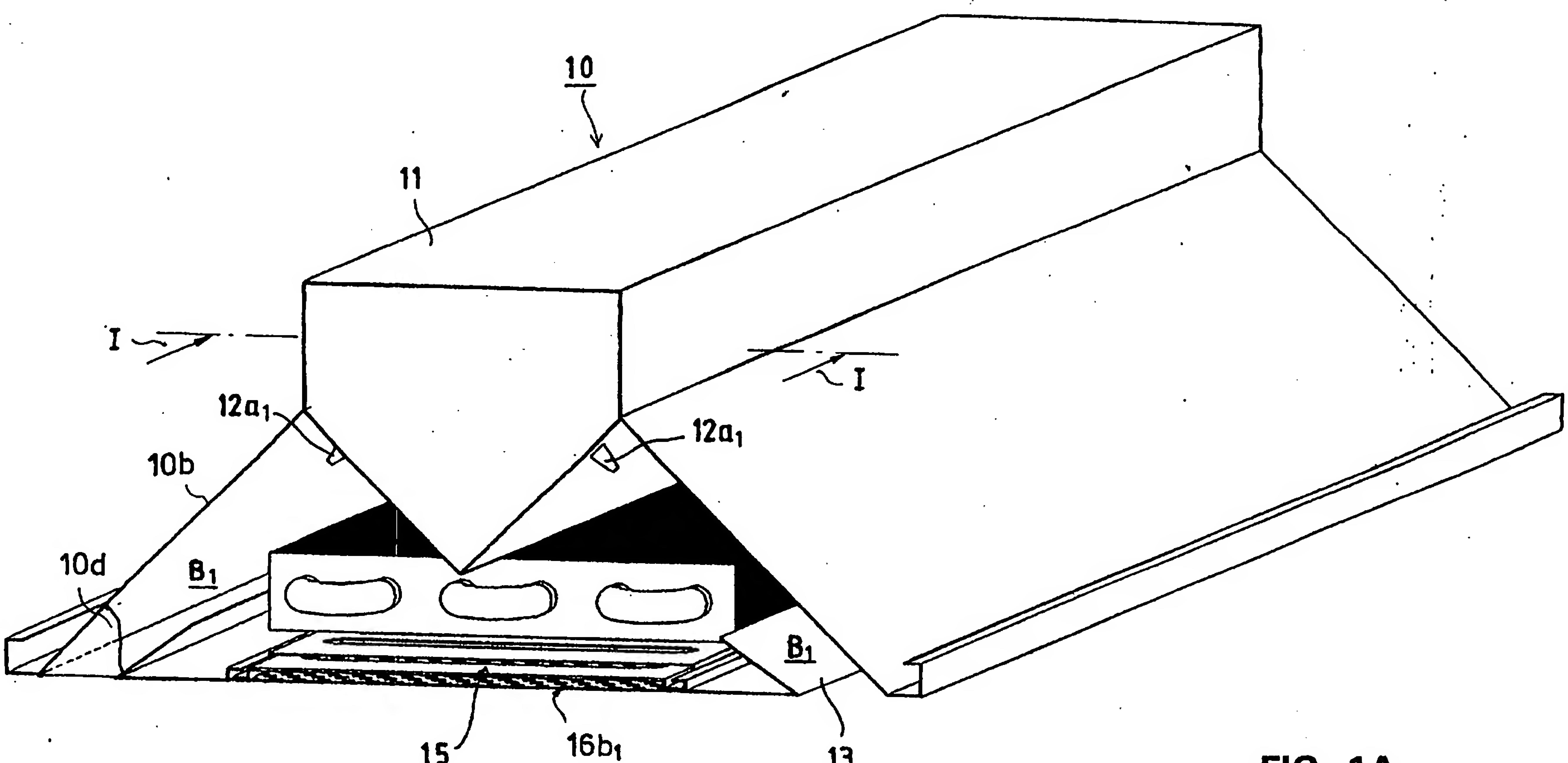

FIG. 1A

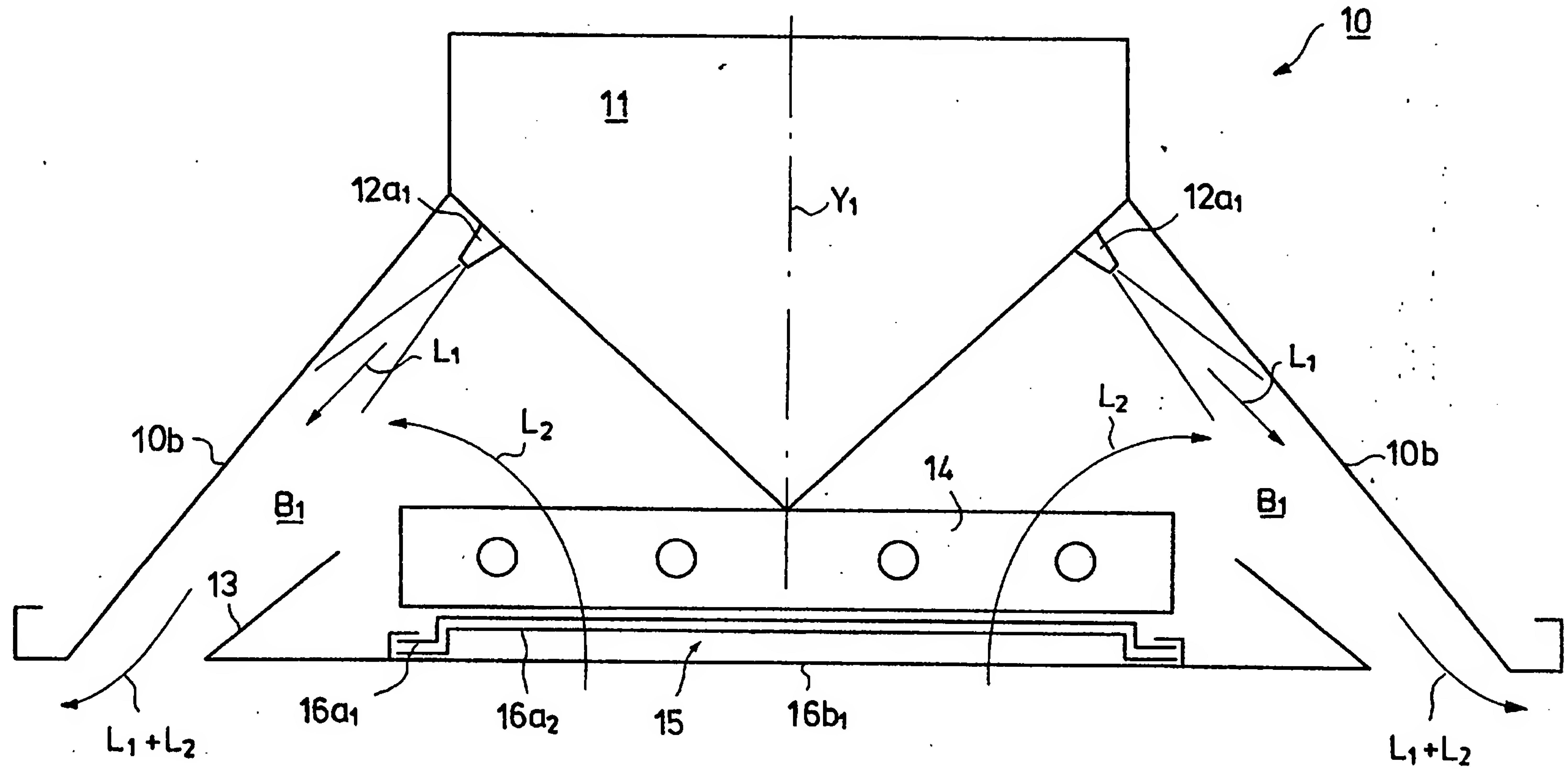
10
11
Y_1
$12a_1$
$12a_1$
L_1
L_1
L_2
L_2
10b
10b
14
B_1
B_1
13
$16a_1$
$16a_2$
15
$16b_1$
L_1+L_2
L_1+L_2

FIG. 1B

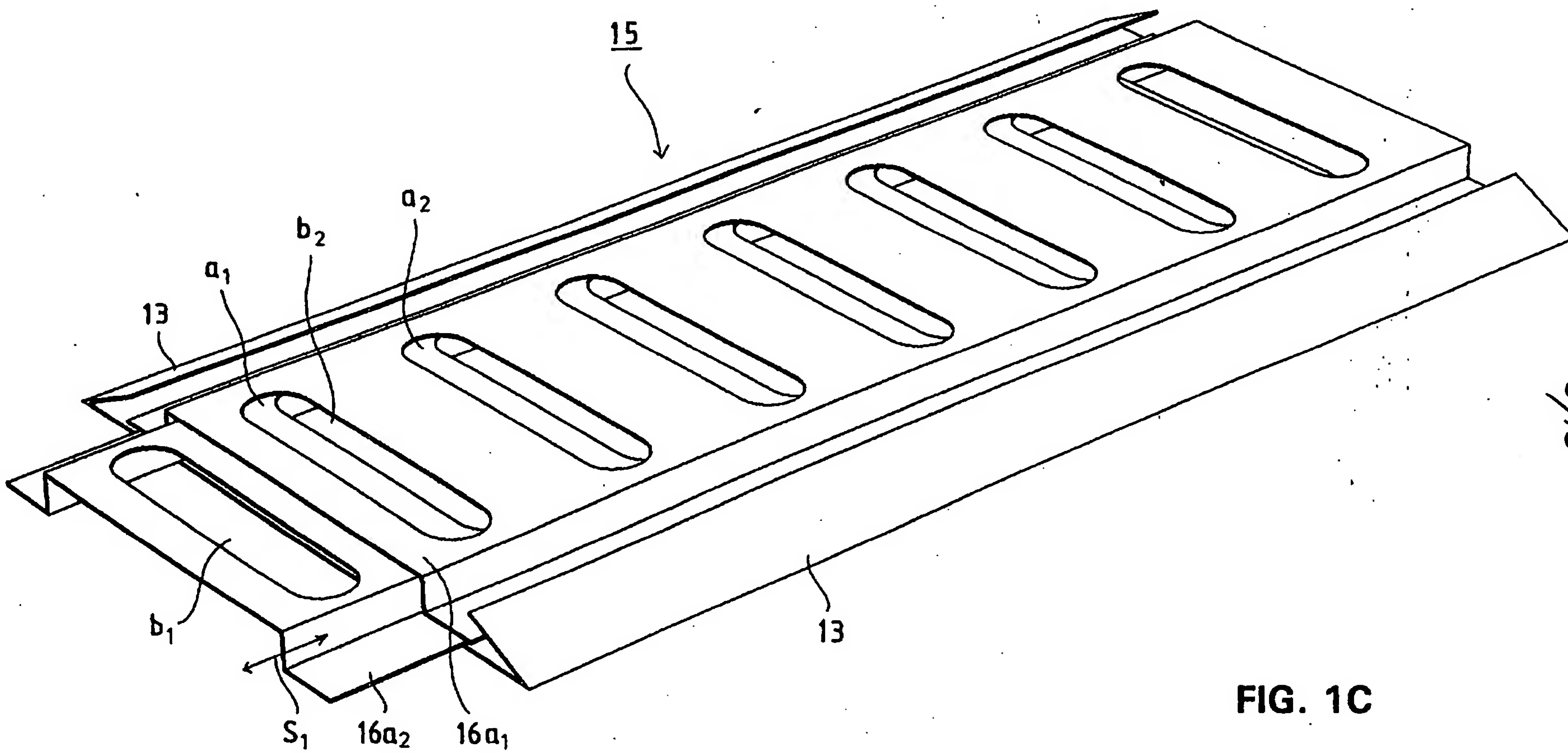

FIG. 1C

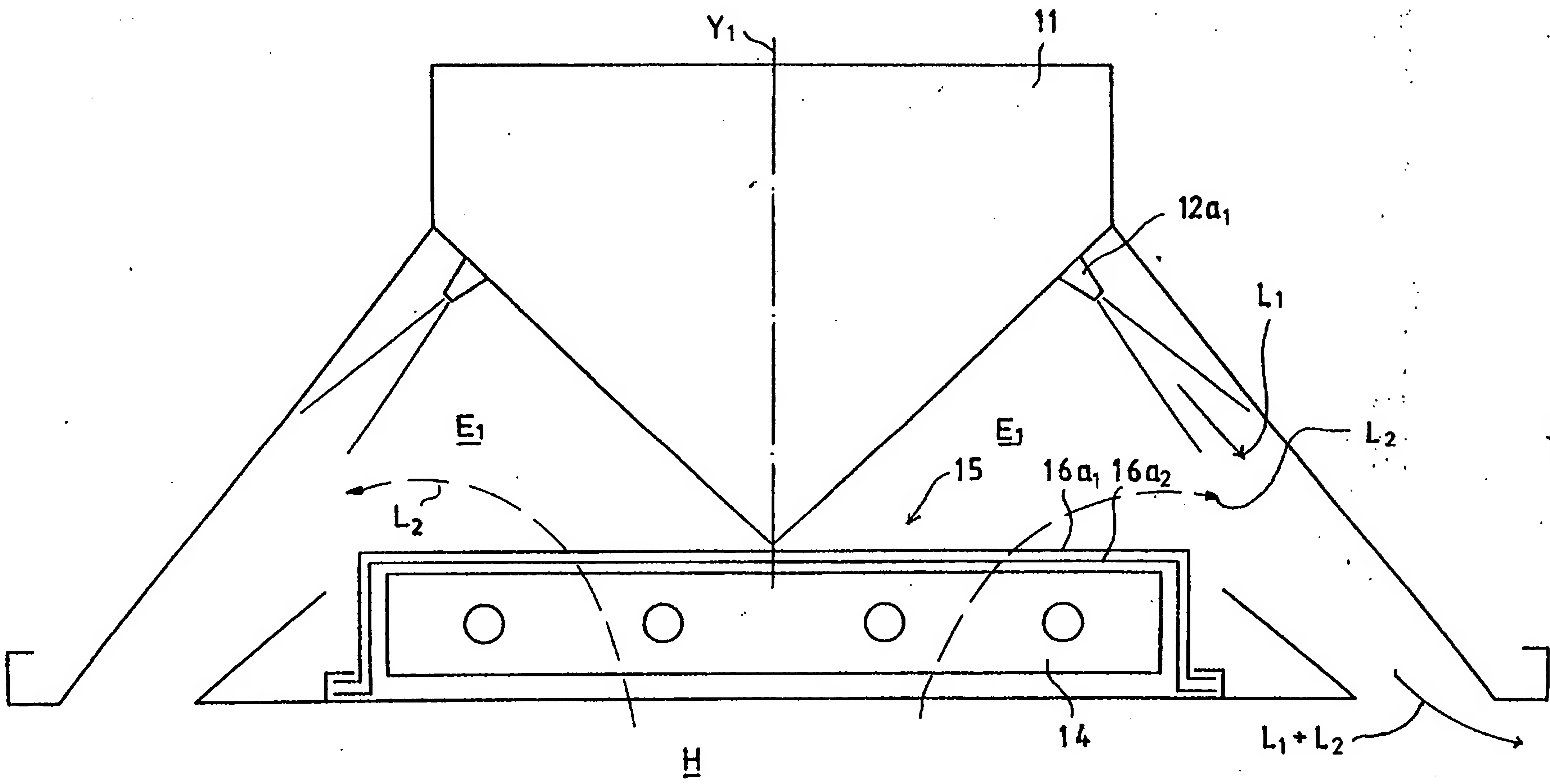

FIG. 1D

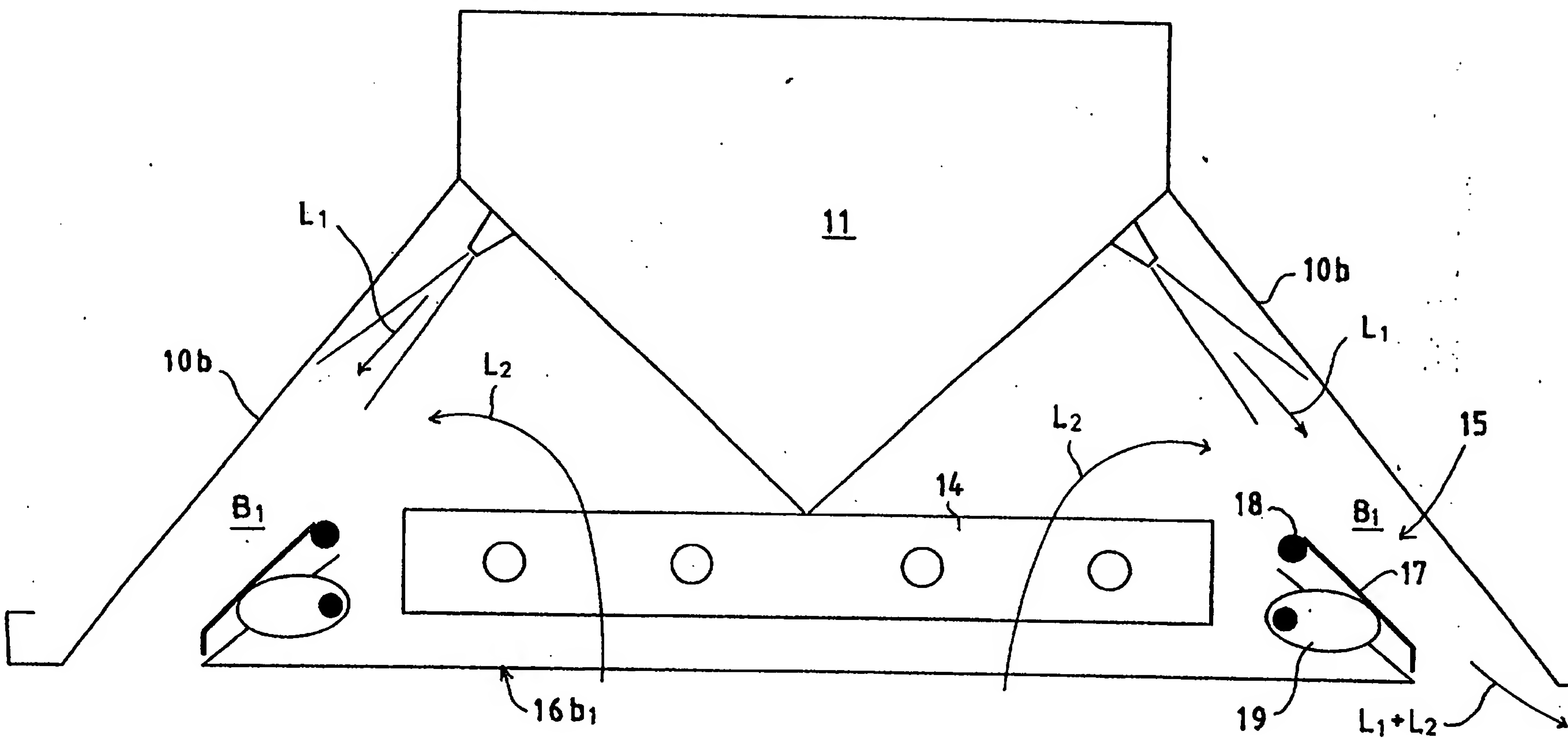

FIG. 2A

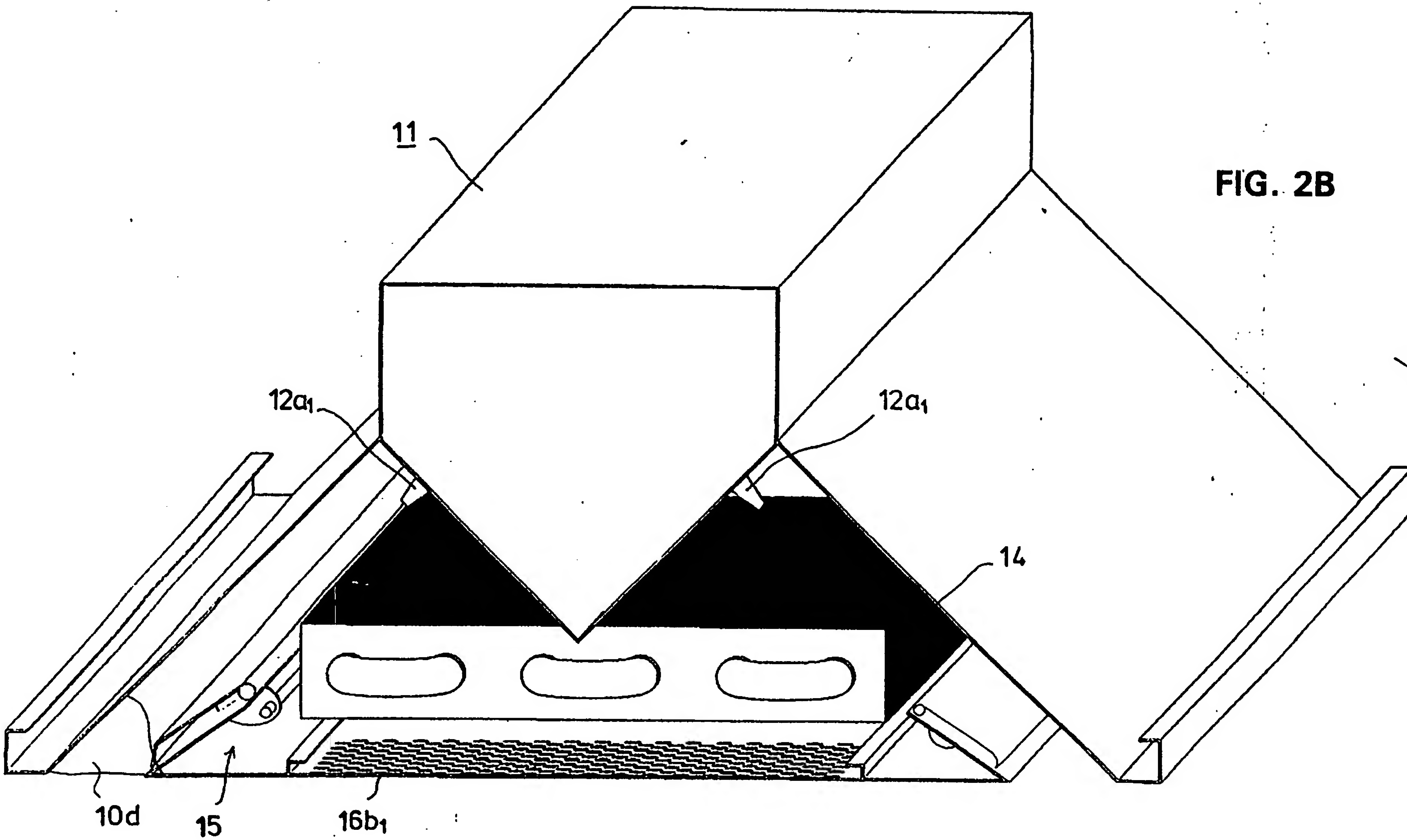

FIG. 2B

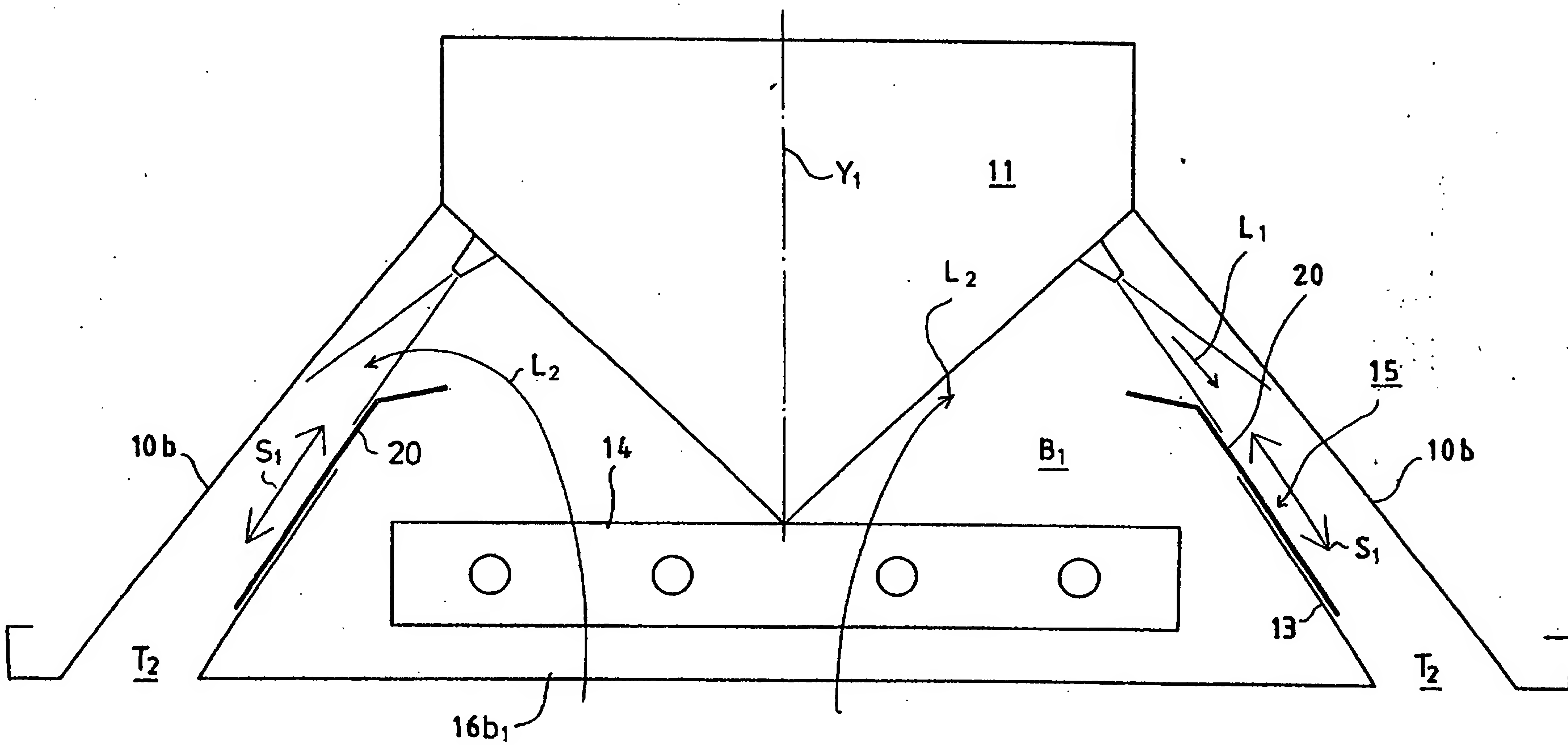

FIG. 3A

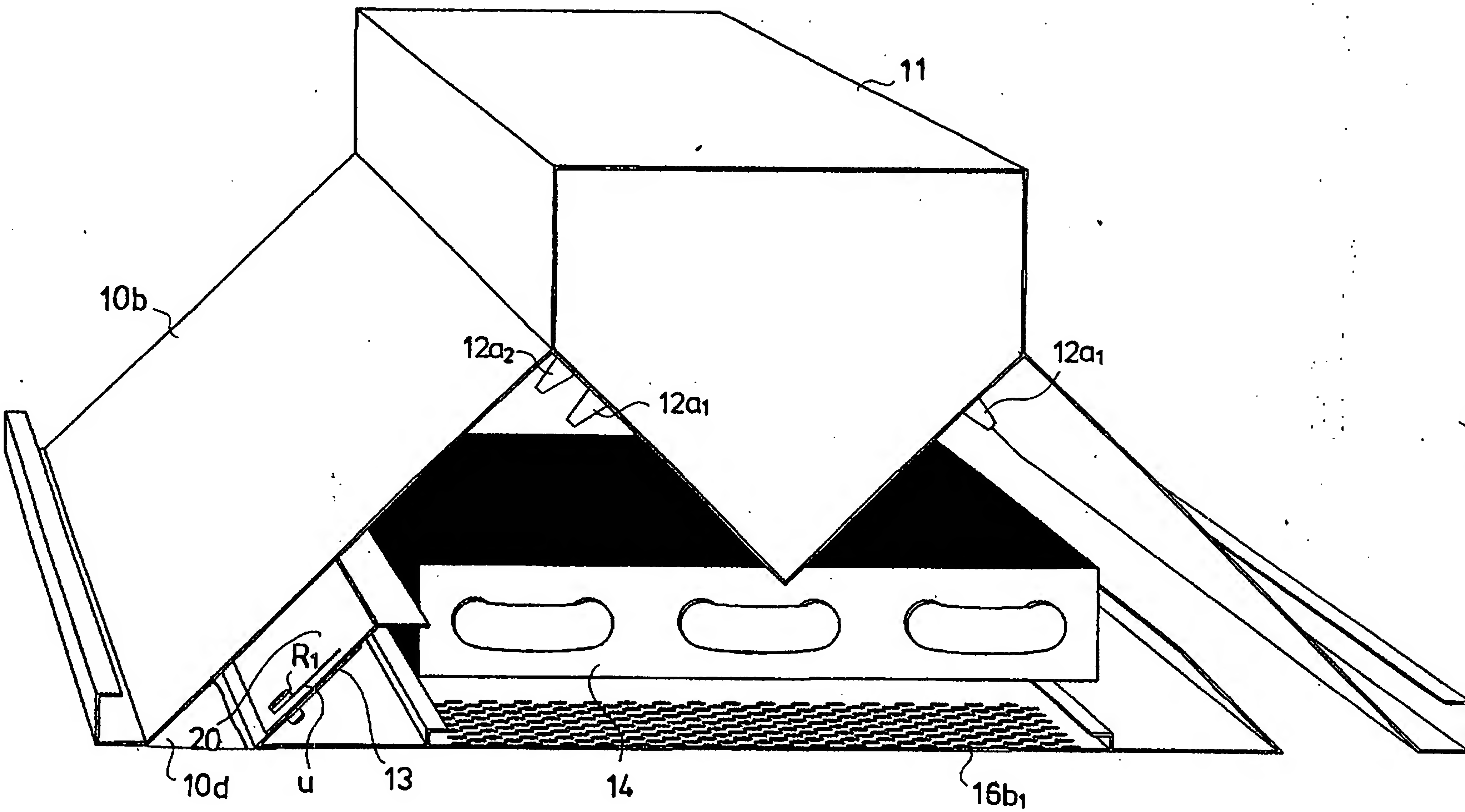

FIG. 3B

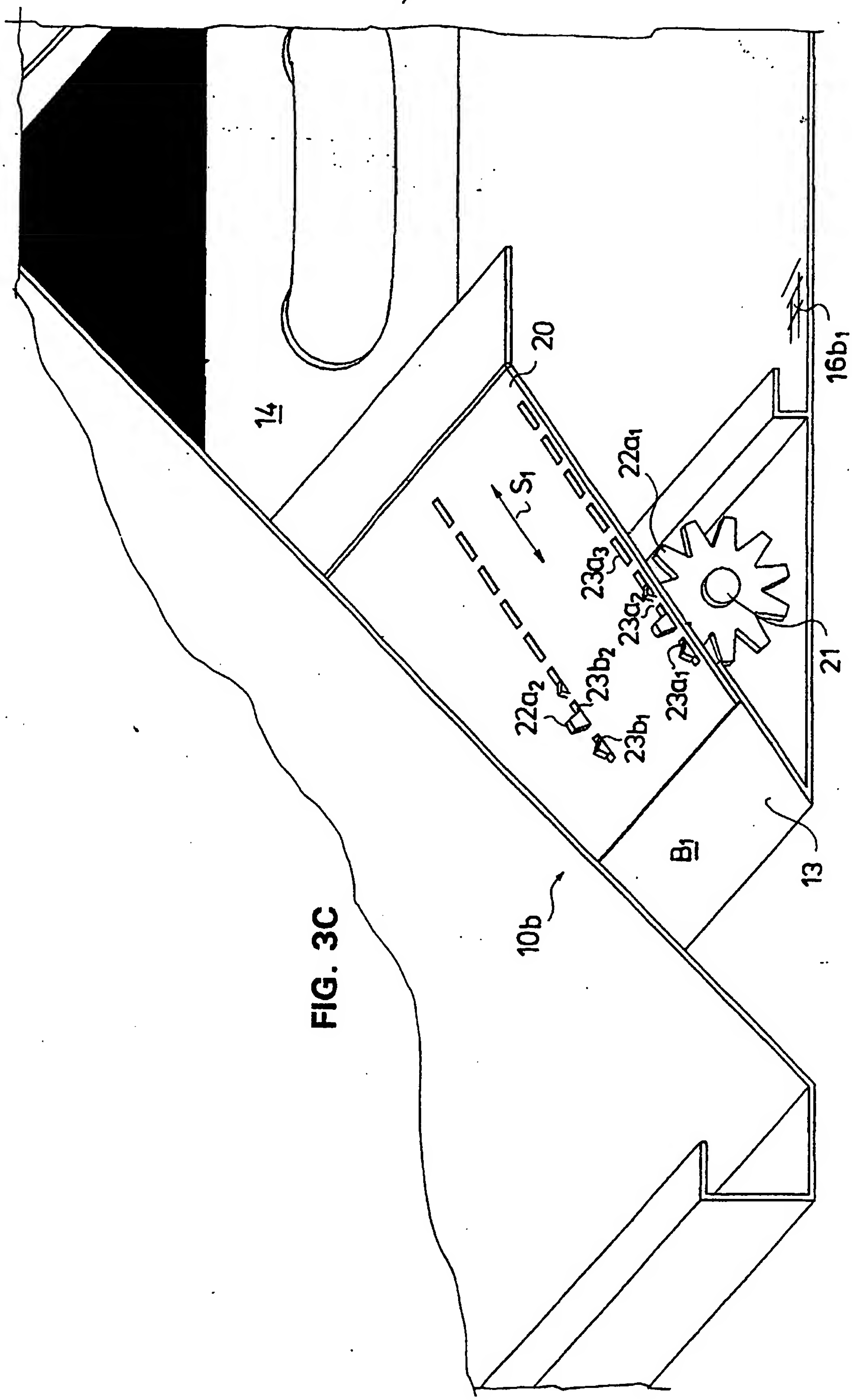

FIG. 3C

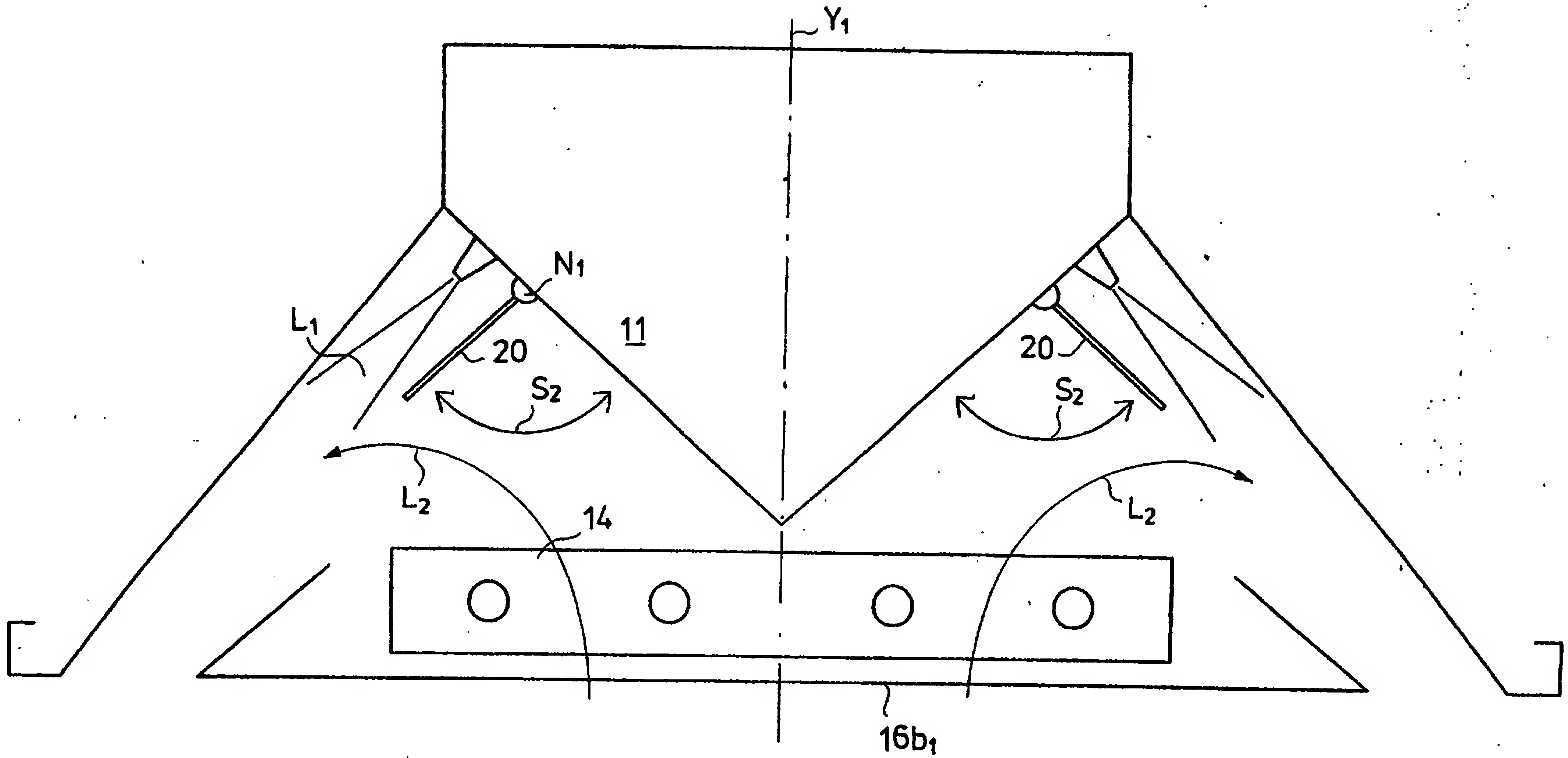

FIG. 3D

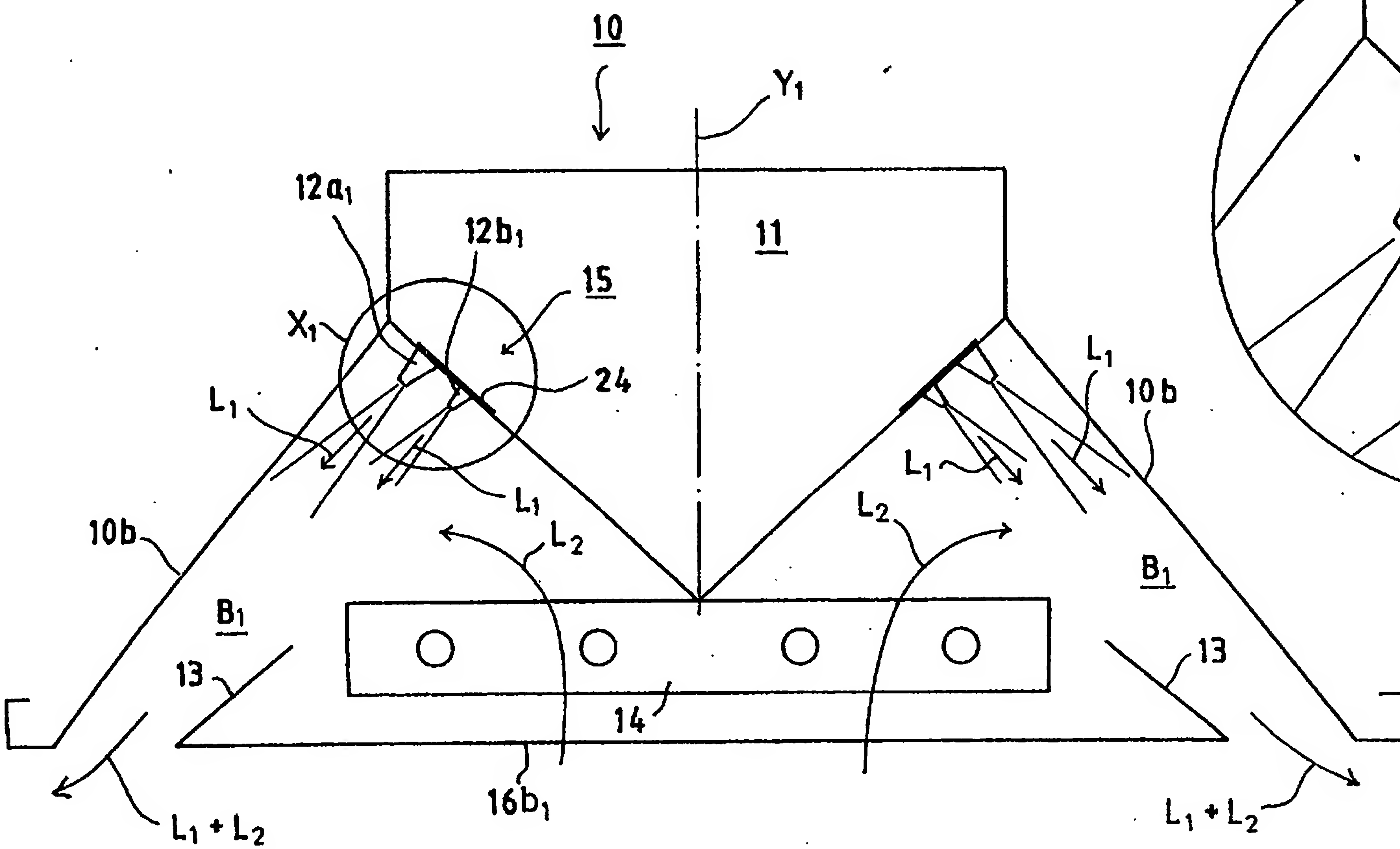
10
Y1
11
12a1
12b1
15
X1
24
L1
L1
L1
L1
10b
10b
L2
L2
B1
B1
13
13
14
16b1
L1 + L2
L1 + L2

FIG. 4A

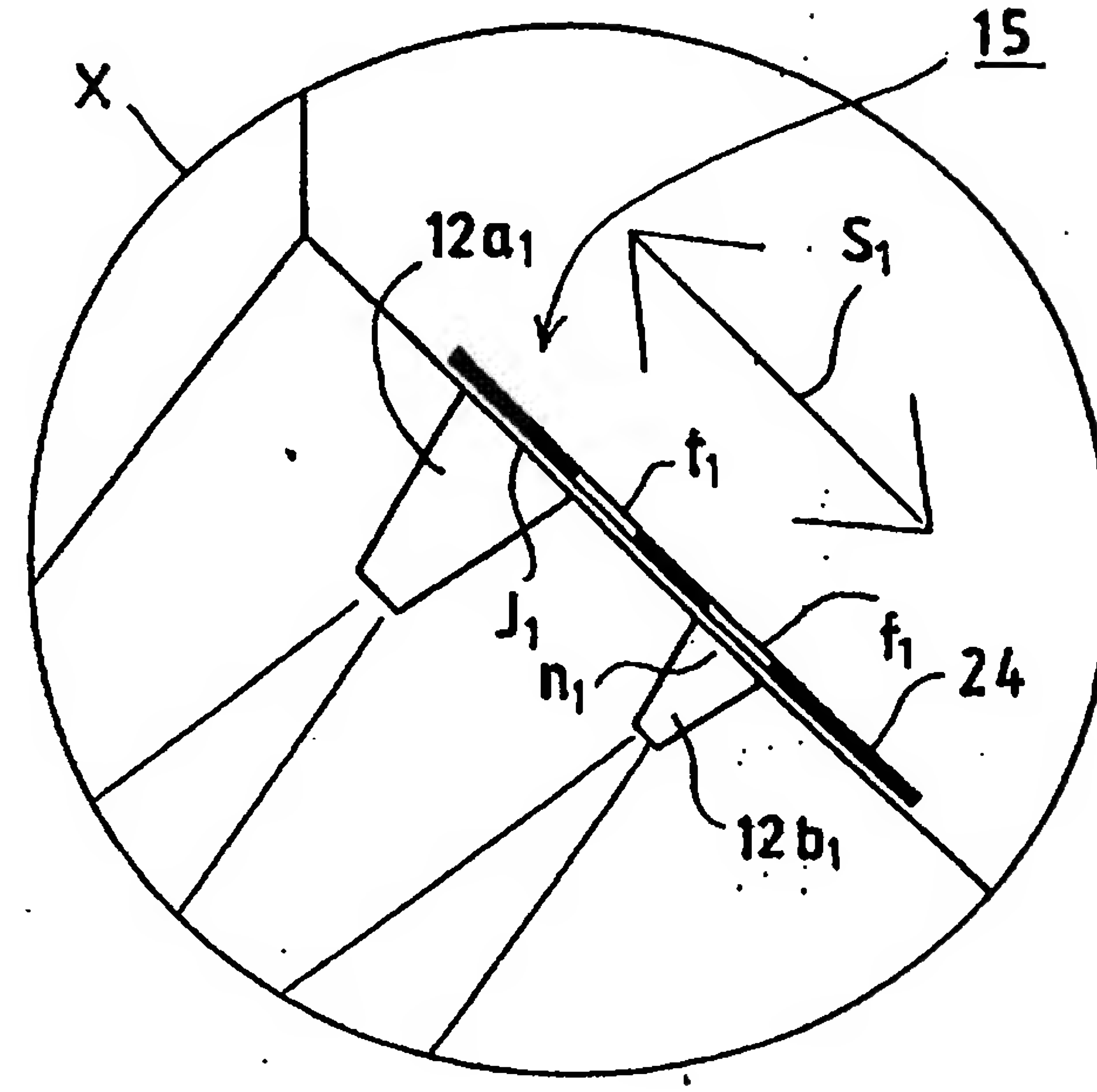
X
15
12a1
S1
t1
J1
f1
n1
24
12b1

FIG. 4B

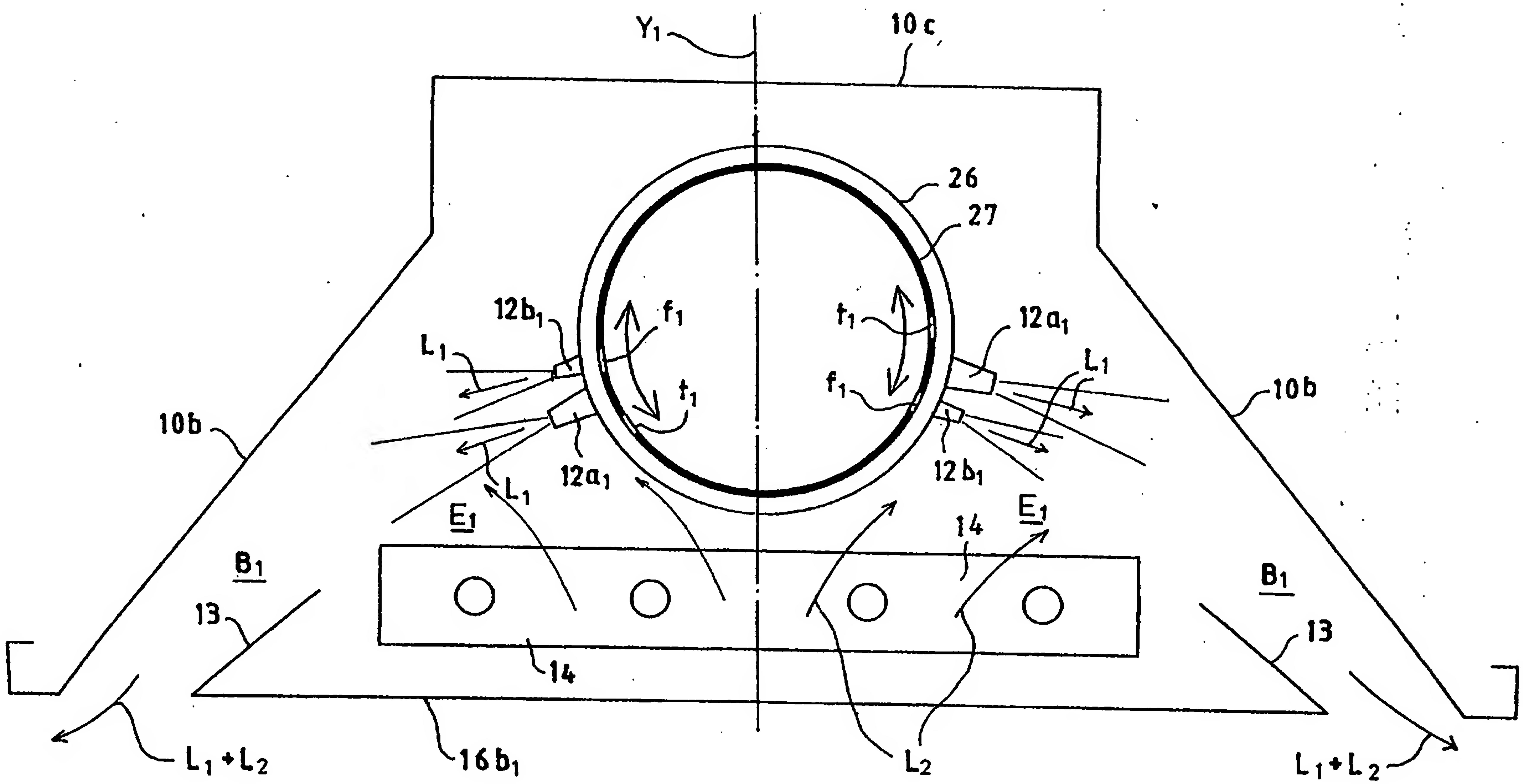

FIG. 5A

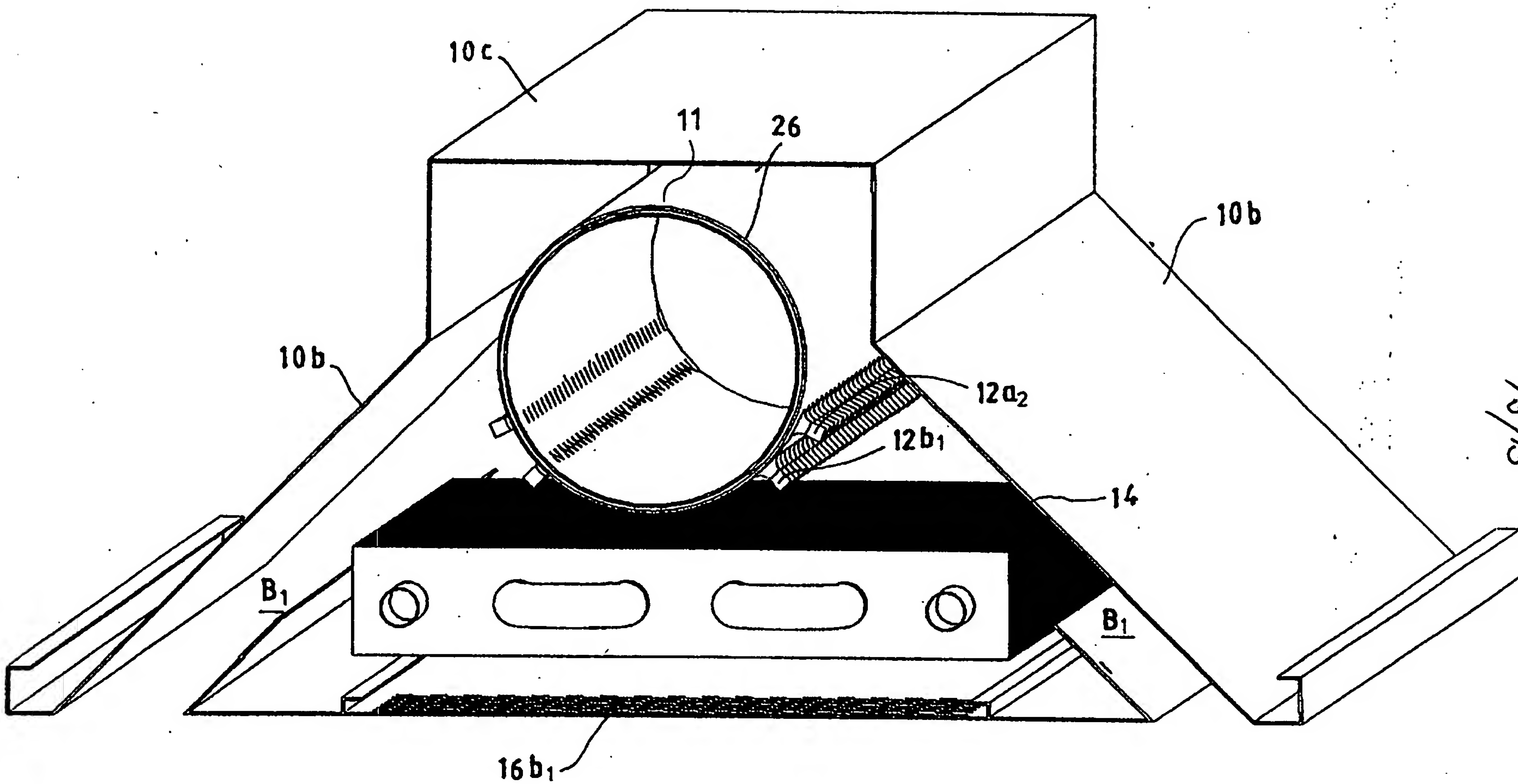

FIG. 5B

Supply air terminal device

The invention concerns a supply air terminal device.

Control of the induction ratio has become a requirement in a supply air terminal device, wherein fresh air is brought by way of the supply air terminal device and wherein room air is circulated through the device. This means that the ratio between the flow volumes of the circulation air flow and the flow of fresh air can be controlled. In the present application primary air flow means that flow of supply air, and preferably the flow of fresh air, which is supplied into the room or such by way of nozzles in the supply air manifold. Secondary air flow means the circulated air flow, that is, that air flow, which is circulated through a heat exchanger from the room space and which air flow is induced by the primary air flow.

For implementation of the above-mentioned control the present application proposes use of a separate induction ratio control device. In one advantageous embodiment, the induction ratio control device is formed by a damper, where the flow of circulated air is controlled on the inlet side of the heat exchanger by controlling the position of holes in a movable aperture plate, which is located in connection with a fixed aperture plate, in relation to the holes in an aperture plate located in a fixed position. Under these circumstances, the flow of circulated air can be throttled, that is, its pressure loss can be controlled on the supply side of the heat exchanger, and the induction ratio is thus controlled through the device. According to the invention, the control device may also be located on the outlet side of the heat exchanger in the mixing chamber. Control may hereby take place by controlling the combined air flow $L_1 + L_2$ of fresh supply air and circulated air. The more the air flow $L_1 + L_2$ is throttled, the lower will the induction ratio be, that is, the air volume made to flow through the heat exchanger becomes smaller

in relation to the primary air flow. According to the invention, the control device may also be located on the supply side of side chamber B_1 after the heat exchanger, whereby e.g. by a plate movable in a linear direction the induction distance of the supply air flow is controlled, and at the same time the concerned flow L_2 of circulated air is controlled. The control plate may be located in the direction of the other channel wall of control mixing chamber B_1 and it may be movable in its direction, e.g. by a motor by remote control or manually.

As is known, a jet having a smaller cross-sectional area will induce more circulated air when travelling the same distance. Besides the above-mentioned ways of controlling the induction ratio, such a control device may also be sued, which is formed by a set of nozzles formed by nozzles in two separate rows opening from the supply chamber for fresh air, whereby the nozzles in the first row are formed with a bigger cross-sectional flow area than the nozzles in the second row. In connection with the said nozzles a control device is located, which is formed by an aperture plate used for controlling the flow between the nozzle rows of the said nozzles.

The supply air terminal device according to the invention is characterised by the features presented in the claims.

In the following, the invention will be described by referring to some advantageous embodiments of the invention shown in the figures of the appended drawings, but the intention is not to limit the invention to these embodiments only.

Figure 1A is an axonometric view of a supply air terminal device according to the invention, which is open at the bottom and closed at the top and on the sides. In the figure, the end wall is cut open in part in order to show the internal structures of the device.

Figure 1B is a cross-sectional view along line I-I of Figure 1A.

Figure 1C is an axonometric partial view of the control device structure.

Figure 1D shows an embodiment of the invention, wherein the induction ratio control device is located after the heat exchanger, looking in the direction of travel of the circulated air flow.

Figure 2A shows another advantageous embodiment of the control device according to the invention, wherein the control device is located in side chamber B_1.

Figure 2B is an axonometric view of a moving mechanism joined to the control device according to Figure 2A.

Figure 3A shows a third advantageous embodiment of a control device connected with the device according to the invention, wherein the control device is fitted to be located on one side wall of side chamber B_1 to close and open the flow path for the circulated air flow from the heat exchanger into the side chamber. Control of the induction distance is hereby carried out.

Figure 3B is an axonometric view of a moving mechanism for the movable plate of a control device according to Figure 3A.

Figure 3C shows a moving mechanism for the movable plate of Figure 3A, which mechanism is formed by toothed gears adapted to move the plate to different control positions.

Figure 3D shows an embodiment of the invention, wherein after the heat exchanger there is a damper articulated to the side chamber and guiding the flow of circulated air from the heat exchanger into side chamber B_1.

Figure 4A shows a fourth advantageous embodiment of the induction ratio control device, wherein the device includes two nozzle rows $12a_1$, $12a_2$ ... and $12b_1$, $12b_2$ ... for the primary air flow L_1, whereby from between the nozzles of the nozzle rows the flow ratio is controlled with the aid of a control plate located in the supply chamber for the primary air flow, which control plate includes flow apertures t_1, t_2 ... for the nozzles of one nozzle row $12a_1$, $12a_2$ ... and flow apertures f_1, f_2 ... for the nozzles of the other nozzle row $12b_1$, $12b_2$ ...

Figure 5A shows an embodiment of the control device, wherein the supply chamber for the primary air flow on both sides of vertical central axis Y_1 in the supply air chamber includes two nozzle rows, whereby the nozzles in the nozzle rows have different cross-sectional flow areas, and the air flow to the nozzles is controlled by an internal tube having flow apertures by rotating the tube, whereby depending on the angle of rotation of the tube, the flow is controlled through different nozzles of the nozzle rows, and thus the induction ratio between flows L_1 and L_2 is controlled.

Figure 5B is an axonometric partial view of the structure shown in Figure 5A.

Figure 1A is an axonometric view of the supply air terminal device 10. For reasons of presentation end wall 10d is cut open in part to show the internal structures. Two end walls 10d and two side plates 10b and a supply air chamber 11 limit side chambers B_1, so that the structure is closed at the top and on the sides but open at the bottom. Fresh air is conducted by way of a channel into supply chamber 11, from which the air is conducted further through nozzles $12a_1$, $12a_2$ ... into side or mixing chambers B_1 of the device on both sides of the vertical central axis Y_1 of the device. The supply air terminal device 11 includes a heat exchanger 14 in between the air guiding parts 13 limiting side chambers B_1 in the central area of the device and below supply air chamber 11. For circulated air L_2 of the room there is a flow path E_1 through heat exchanger 14 into side chambers B_1. The said air flow L_2, that is, the secondary air flow, is brought about by the primary air flow

from nozzles $12a_1$, $12a_2$ ... of supply chamber 11. In the side chambers B_1 the air flows $L_1 + L_2$ are combined, and the combined air flow is made to flow to the side guided by the air guiding parts 13 and the side plates 10b of the supply air terminal device.

According to the invention, the supply air terminal device 10 includes an induction ratio control device 15. In the embodiment shown in Figure 1A, the control device 15 is formed by an aperture plate structure controlling the circulated air flow L_2, which aperture plate structure in the embodiment shown in Figure 1A is fitted in between the air guiding parts 13 in relation to the direction of flow of the circulated air flow L_2 before the heat exchanger 14.

Figure 1B is a cross-sectional view along line I-I of Figure 1A of a first advantageous embodiment of the invention. Supply air terminal device 10 includes a supply air chamber 11 for the supply air L_1, from which the air is conducted through nozzles $12a_1$, $12a_2$ ... into the side or mixing chamber B_1 of the device and further into room space H. Supply air chamber 11 closes the device 10 from the top. Circulated air L_2 induced by the fresh air flows into side chamber B_1 from room H, whereby the combined air flow $L_1 + L_2$ flows further away from the device, preferably to the side in the horizontal direction at ceiling level. According to the invention, the body R of the device includes side plates 10b and an air guiding part 13, which limit the chamber B_1 located at the side of the device. The circulated air flow L_2 flows from the centre of the device from between the air guiding parts 13 by way of the heat exchanger 14 located in the central part of the device into side chamber B_1 induced by the supply air flow L_1. Air guiding part 13 and side plates 12 are shaped in such a way that the combined air flow $L_1 + L_2$ will flow in the horizontal direction to the side and preferably in the ceiling level direction and along this in the horizontal direction. The heat exchanger 14 may be used for cooling or heating the circulated air.

The embodiment of Figure 1B in between air guiding parts 13 is an induction ratio

control device 15, which is used for controlling the flow volume of circulated air flow L_2 through heat exchanger 14. Hereby the induction ratio Q_2/Q_1 is controlled, wherein Q_2 is the flow volume of the circulated air flow L_2 and Q_1 is the flow volume of the supply air L_1, that is, of the primary air flow L_1. The induction ratio Q_2/Q_1 is preferably within a range of 2-6.

In the embodiment shown in Figures 1A and 1B, there are preferably aperture plates $16a_1$, $16a_2$ before heat exchanger 14 in between the air guiding parts 13 of the device, looking in the direction of flow of the circulated air flow L_2, whereby the circulated air flow L_2 conducted through the aperture plates is guided further through heat exchanger 14 into side chambers B_1. As was described above, the combined air flow $L_1 + L_2$ is guided away from the device, preferably with the aid of air guiding parts 13 guided by these in a horizontal direction to the side. The device is symmetrical in relation to vertical axis Y_1.

Figure 1C is a separate view of the induction ratio control device 15. Control device 15 is formed by an aperture plate structure, wherein the structure includes in relation to a first aperture plate $16a_1$ in a fixed position a second movable aperture plate $16a_2$, whereby the apertures a_1, a_2 ..., b_1, b_2 ... of the aperture plate $16a_1$, $16a_2$ can be placed in different covering positions in relation to each other, whereby the total cross-sectional flow area through the aperture surface can be controlled and thus the air flow through the aperture surface can be controlled. Thus, that flow L_2 can be controlled, which is made to flow through heat exchanger 14. Flow L_2 may be closed off entirely in certain conditions of operation.

Figure 1D shows an embodiment of the invention, wherein the induction ratio control device 15 is also formed by an aperture plate structure $16a_1$, $16a_2$, which as seen in the direction of flow of the circulated air flow L_2 is fitted on the discharge side of heat exchanger 14. Both in the embodiment shown in Figures 1A, 1B and in the embodiment shown in Figure 1D the structure may also include an

architectural third aperture plate or such $16b_1$, which is fitted as a structure opening into the room and preventing visibility into control device 15.

In the embodiment shown in Figure 2A, the side chamber B_1 now includes an induction ratio control device 15 according to the invention. In the embodiment shown in the figure, the control device 15 is formed by a longitudinal damper 17, which can be rotated supported by a joint 18 into different control positions in chamber B_1. By turning an eccentric piece 19 the desired control positions are achieved for the damper 17. Both side chambers B_1 include a similar induction ratio control device 15 as shown in Figure 2A.

Figure 2B is an axonometric and partial view of the damper 17 of the embodiment shown in Figure 2A. The circulated air flow L_2 flows through aperture plate 16b or such to heat exchanger 14 and further into side chamber B_1. The induction ratio is controlled by moving damper 17 in side and mixing chamber B_1.

Figure 3A shows an embodiment of the invention, wherein the induction ratio control device 15 for controlling the induction ratio between the primary air flow L_1 and the circulated air flow L_2 is formed by a longitudinal plate 20, which is moved in a linear direction to close and open a flow path E_1 for the circulated air flow L_2 from heat exchanger 14 into mixing chamber B_1 (arrow S_1). The plate 20 is fitted to close and open the flow path for the circulated air flow L_2 between air guiding part 13 and supply air chamber 11. By moving the plate 20 into different control positions the distance induced by the supply air jet L_1 is controlled in side chamber B_1. The structure is symmetrical in relation to vertical central axis Y_1. The circulated air flow L_2 flows through an aperture plate $16b_1$ or such to heat exchanger 14 and further through flow path E_1 into mixing and side chamber B_1 in connection with supply air flow L_1. The combined air flow $L_1 + L_2$ leaves the device as shown in the figure through the aperture T_2 below mixing chamber B_1. Aperture T_2 is preferably a longitudinal flow gap.

Figure 3B is an axonometric view of the embodiment shown in Figure 3A. A screw R_1 can be turned into air guiding part 13 and at the same time plate 20 is fastened in a certain control position. Plate 20 includes a groove U_1, whereby plate 20 can be moved to the desired position in order to control the induction ratio between the flows L_1 and L_2.

Figure 3C is an axonometric view of an advantageous embodiment of control device 15, wherein the plate 20 of control device 15 is moved by rotating shaft 21 manually or with the aid of a motor, preferably an electric motor, which shaft 21 includes toothed gears $22a_1$, $22a_2$ connecting with apertures $23a_1$, $23a_2$ ..., $23b_1$, $23b_2$ ... in plate 20.

Figure 3D shows an embodiment of the invention, wherein between air guiding parts 13 and supply air chamber 11 there is attached to the supply air chamber a longitudinal damper 20 turning around its joint N_1. Thus, in the embodiment shown in the figure the induction ratio control device 15 is formed by a turning damper 20, which guides the circulated air flow L_2 from heat exchanger 14 into side chamber B_1. By turning the damper 20 the induction distance of flow L_1 is affected and thus the induction effect of flow L_1 in relation to flow L_2 is affected. Turning of the damper 20 is indicated by arrows S_2.

Figure 4A shows an embodiment of the invention, wherein the induction ratio control device 15 is fitted in connection with nozzles $12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ... in such a way that on the supply side of the nozzles there is an aperture plate 24, which can be brought into different control positions in relation to the supply apertures j_1, j_2 ...; n_1, n_2 ... of nozzles $12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ...

Figure 4B is a view on a larger scale of area X_1 in Figure 4A. By moving control plate 24 as shown by arrow S_1 in a linear direction the position of the apertures in control plate 24 is affected in relation to the supply apertures j_1, j_2 ...; n_1, n_2 ... of nozzles $12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ... When, in addition, the desired cross-sectional

flow areas are chosen for nozzles $12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ... in relation to each other, the desired induction ratio can be controlled between flows L_1 and L_2. In the embodiment shown in Figure 4A, the supply air chamber 11 includes two rows of nozzles side by side; a row of nozzles formed by nozzles $12a_1$, $12a_2$ ..., wherein the cross-sectional flow area of the nozzles is bigger than the cross-sectional flow area of the nozzles in the row of nozzles $12b_1$, $12b_2$ ... located below. By moving control plate 24 as shown by arrow S_1 in Figure 4B in a linear direction the air flow L_1 from supply chamber 11 through nozzles $12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ... is controlled. Thus, by moving the control plate 25 in a linear direction (arrow S_1) in relation to the supply apertures j_1, j_2 ...; n_1, n_2 ... of nozzles $12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ... the supply air flow L_1 can be throttled and guided as desired. The flow apertures f_1, f_2 ..., t_1, t_2 ... located in two different rows in control plate 24 are brought into different covering positions in relation to the supply apertures j_1, j_2 ...; n_1, n_2 ... of nozzles $12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ... By increasing the flow through some nozzles the flow through other nozzles is reduced and vice versa. The flow rate of flow L_1 into chamber B_1 is controlled and thus the induction ratio Q_2/Q_1 between the flows L_2 and L_1 is controlled.

Figure 5A shows an embodiment of the supply air terminal device according to the invention, wherein the supply air chamber 11 is formed by a channel shaped with a circular cross-section and including on both sides of central axis Y_1 nozzles $12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ... , however, so that as shown in the figure on the left side there are the nozzles $12b_1$, $12b_2$ ... with the smaller cross-sectional flow area above the row of nozzles $12a_1$, $12a_2$ ... with the bigger cross-sectional flow area, and on the right side of central axis Y_1 in the figure the order of nozzles is the other way round, that is, the row of nozzles $12b_1$, $12b_2$ ... with the smaller cross-sectional flow area is located below the row of nozzles $12a_1$, $12a_2$ ... with the bigger cross-sectional flow area. Inside supply air chamber 11 there is an induction ratio control device 15 in the form of a turning tube 27, which includes flow apertures f_1, f_2 ..., t_1, t_2 ... for the nozzles $12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ... located on both sides of central axis Y_1. Thus, by turning the tube 27 the air is made to

flow e.g. as shown in the figure only through the nozzles $12a_1$, $12a_2$ ... with the bigger cross-sectional flow area or through the nozzles $12b_1$, $12b_2$ ... with the smaller cross-sectional flow area. In this way the flow rate of flow L_1 can be controlled in side chamber B_1 and thus the induction effect of the said flow L_1 on flow L_2 is controlled. By controlling flow L_1 the desired induction ratio between the flows L_2 and L_1 is thus controlled. As is shown in the figure, the supply chamber 11 with the circular cross section is located above heat exchanger 14 and centrally in the structure. In the embodiment shown in the figure, the device includes a top ceiling plate 10c connecting the side plates 10b, whereby the structure is formed as one which is closed at the top and on the sides and which is open downwards.

Figure 5B is an axonometric partial view of the device in Figure 5A.

Claims

1. Supply air terminal device (10) including side plates (12) and an air guiding part (13), whereby a heat exchanger (14) is fitted in the device below the supply air chamber (11) for supply air in between air guiding parts (13) located on both sides of the central axis (Y_1) of the device, whereby in the device the supply air chamber (11) includes nozzle apertures ($12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ...) to guide fresh supply air into a side chamber (B_1) and to induce a flow of circulated air (L_2) from the room space through the heat exchanger (14) into the side chamber (B_1), whereby the heat exchanger (14) can be used to either cool or heat the circulated air, **characterised** in that the equipment includes a control device (15) for the induction ratio between the supply air flow (L_1) and the circulated air flow (L_2), which control device can be used to control in which ratio there is fresh air (L_1) and circulated air (L_2) in the combined air flow ($L_1 + L_2$).

2. Supply air terminal device according to claim 1, **characterised** in that the induction ratio control device (15) is fitted in between air guiding parts (13) limiting the side chamber (B_1) of the device.

3. Supply air terminal device according to claim 2, **characterised** in that the induction ratio control device (15) is fitted on the inlet flow side of the heat exchanger (14), that is, before the heat exchanger (14), in relation to the flow direction of the circulated air flow (L_2).

4. Supply air terminal device according to claim 2, **characterised** in that the induction ratio control device (15) is fitted after the heat exchanger (14) as seen in the flow direction of the circulated air flow (L_2).

5. Supply air terminal device according to claim 3 or 4, **characterised** in that the control device (15) includes an aperture plate ($16a_1$) in a fixed position and another movable aperture plate ($16a_2$), whereby by moving the movable aperture

plate ($16a_2$) the position of the apertures (a_1, a_2 ...) in the movable aperture plate can be controlled in relation to the apertures (b_1, b_2 ...) in the aperture plate ($16a_1$) in a fixed position and the total cross-sectional flow area through the aperture plates ($16a_1$, $16a_2$) can also be controlled and thus the flow volume of the circulated air flow (L_2) can also be controlled.

6. Supply air terminal device according to claim 1, **characterised** in that the side chamber (B_1) includes a control device (15), which is formed by a turning damper (17) located in the side chamber (B_1), which damper is used to open or close a flow path in the side chamber (B_1) for the combined air flow ($L_1 + L_2$).

7. Supply air terminal device according to claim 1, **characterised** in that the control device (15) is fitted in between the side chamber (B_1) and the heat exchanger (14) to close and open a flow path (E_1) for the circulated air flow (L_2) into the side chamber (B_1), whereby the induction distance of the supply air flow (L_1) in the side chamber (B_1) is controlled.

8. Supply air terminal device according to the preceding claim, **characterised** in that the control device (15) is a plate (20), which is moved in a linear direction either manually or with the aid of a motor and which plate (20) is moved between an air guiding part (13) and the supply air chamber (11) to close and open the flow path (E_1) between these for the circulated air flow (L_2), whereby the induction distance is controlled and thus the induction ratio between the flows ($L_1 + L_2$) is controlled.

9. Supply air terminal device according to the preceding claim, **characterised** in that there is a shaft (21), which includes toothed gears ($22a_1$, $22a_2$), whereby by rotating the shaft (21) the toothed gears ($22a_1$, $22a_2$) are rotated, which connect with the plate (20) moving it.

10. Supply air terminal device according to claim 8, **characterised** in that the

plate (20) can be locked manually with screws (R_1) in the desired control position.

11. Supply air terminal device according to claim 8, **characterised** in that the plate (20) forms a damper, which can be turned around its joint (N_1), and that the damper (20) is articulated to the supply air chamber (11) to turn around its joint (N_1).

12. Supply air terminal device according to claim 1, **characterised** in that the supply air terminal device in connection with the nozzles ($12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ...) of two nozzle rows in the supply air chamber (11) includes a control plate (24) of the induction ratio control device (15) for increasing or reducing the pressure loss of the supply air flow (L_1), that is, for increasing or reducing throttling of the flow (L_1).

13. Supply air terminal device according to claim 12, **characterised** in that the control device (15) is formed by a control plate (24), which includes flow apertures (f_1, f_2 ..., t_1, t_2 ...), which close and open a flow path to the nozzles ($12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ...), which nozzles ($12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ...) are located in two separate rows and have cross-sectional flow areas different from each other, whereby the control device (15) can be used to control the flow either through the nozzles ($12a_1$, $12a_2$ ...) having the bigger cross-sectional flow area or through the nozzles ($12b_1$, $12b_2$ ...) having the smaller cross-sectional flow area, and thus to control the induction distance of the flow of primary air flow (L_1) in the side chamber (B_1) and thus also to control the inducing effect of the said primary air flow (L_1) on the flow of secondary air (L_2) made to flow through the heat exchanger (14).

14. Supply air terminal device according to claim 12 or 13, **characterised** in that the supply air terminal device inside the supply air chamber (11) includes an internal control tube (27) having a circular cross section and therein flow apertures (f_1, f_2 ..., t_1, t_2 ...) on both sides of the vertical central axis (Y), whereby by

rotating the control tube (27) its position can be controlled in relation to the nozzles ($12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ...) located in two separate rows in the supply air chamber (11), whereby the first nozzles ($12a_1$, $12a_2$ ...) in the first row have different cross-sectional flow areas than the nozzles ($12b_1$, $12b_2$ ...) in the second row, whereby the control tube (27) can be used to control the flow into the nozzles ($12a_1$, $12a_2$ ..., $12b_1$, $12b_2$ ...) of the separate nozzle rows, and thus the air flow rate of the primary air flow (L_1) into the side chamber (B_1) can be controlled and also the inducing effect of the primary air flow (L_1) on the circulated air flow (L_2) can also be controlled, which circulated air flow arrives through the heat exchanger (14) to combine with the primary air flow (L_1).

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Application No:	GB 0127440.6	**Examiner:**	Tyrone Moore
Claims searched:	1-14	**Date of search:**	15 May 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): F4V(VGAB, VGBB, VGBR, VGBS)

Int Cl (Ed.7): F24F

Other: ONLINE: WPI, EPODOC, JAPIO.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X, Y	EP 0967443 A2	(STIFAB) See figure 1, item 30 and the description in column 3 at lines 51-58.	X:1 at least Y: 3, 4, 5, 6, 12
X, Y	US 2937588	(MASIN) See figure 2, item 52 and the description in column 5 at lines 6-28.	X:1 at least Y: 3, 4, 5, 6, 12
Y	GB 1011742	(CARRIER) See figures 1-4, especially fig.2, item 10 and the description on page 2 at lines 9-25.	2, 4 3, 5
Y	EP 0924475 A1	(KYORITSU) see figures 1-10 and the description. This document describes a damper for controlling air flow relevant to claim 6.	6
Y	US 5427146	(BAKKEN) See figures 1-6, especially fig.2 item 16 and the description in column 5 at lines 4-20.	5

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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Application No: GB 0127440.6
Claims searched: 1-14

Examiner: Tyrone Moore
Date of search: 15 May 2002

Category	Identity of document and relevant passage		Relevant to claims
Y	US 3186327	(GIURLANDO) See figures 1-9, especially figs 5, 9, items 23, 27 and the description in column 3 at lines 64 to column 4 at line 45.	5, 12
Y	JP 030137429 A	(KIMURA) See figures 1-3 and the JAPIO abstract, especially, *"At the opening of each of the air inlets there is provided an air flow-controlling device 6 designed to be freely opened and closed or removed so as to function to control the amount of the air passing through the air inlet 4.The air flow- controlling device 6 consists of an ordinary damper mechanism is which a motor 12 moves a movable plate to the right or left or upward or downward in controlling the opening. An alternative method is to form a multiplicity of orifices as air holes in the air inlet 4 and, by mutually moving an air flow-controlling plate and a movable plate in a manner of sliding, the amount of the air passing through the air holes is changed".*	5
Y	JP 620297656 A	(KYUSHU) See figures 1, 1a and the JAPIO abstract relevant to claims 1 and 5.	5
A	US 5218998	(BAKKEN) See figures 1-10. And the description. This document describes an air flow control device that is semi circular in cross-section, relevant to claim 14.	
A	DE 3321612 A1	(HOWALDTSWERKE) See figure 1 and the EPODOC, WPI abstracts. Relevant to claim 1.	
A	DE 029609754 U1	(TROX) See figures 1-2, and the WPI abstract. Relevant to claim 1.	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
		E	Patent document published on or after, but with priority date earlier than, the filing date of this application.
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